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Preliminary Evaluation of Resource Recovery as an Industrial Development Catalyst for Catawba County, North Carolina

CSI Resource Systems, Inc.
Boston, MA

Prepared for

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Analysis has been performed to determine the feasibility of utilizing resource recovery as an incentive for industry to locate new facilities in Catawba County, North Carolina. This report discusses the selection of a technically suitable resource recovery alternative for Catawba County; an economic evaluation of that option based on the premise that a suitable energy market can be secured; the obstacles and opportunities associated with the concept of exploiting resource recovery as an industrial development catalyst and steps the County can take toward project implementation once a suitable energy market is identified.

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Preliminary Evaluation of Resource Recovery as an Industrial Development Catalyst for Catawba County, North Carolina

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Technical assistance by personnel teams. 42 USC 6913

RESOURCE RECOVERY AND CONSERVATION PANELS

SEC. 2003. The Administrator shall provide teams of personnel, including Federal, State, and local employees or contractors (hereinafter referred to as "Resource Conservation and Recovery Panels") to provide States and local governments upon request with technical assistance on solid waste management, resource recovery, and resource conservation. Such teams shall include technical, marketing, financial, and institutional specialists, and the services of such teams shall be provided without charge to States or local governments.

This report has been reviewed by the Project Officer, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Project Officer: Elmer G. Cleveland

PRELIMINARY EVALUATION OF RESOURCE RECOVERY AS AN INDUSTRIAL DEVELOPMENT CATALYST FOR CATAWBA COUNTY, NORTH CAROLINA

Prepared for
OFFICE OF SOLID WASTE MANAGEMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV, ATLANTA, GEORGIA

By
CSI RESOURCE SYSTEMS, INC.

October 1981

PREFACE

This report was prepared for Catawba County, North Carolina, under the Technical Assistance and Panels Program, which is conducted by the U.S. Environmental Protection Agency (EPA) to provide assistance to state and local governments. Technical assistance was provided in response to requests submitted to U.S. EPA Region IV by Catawba County.

This report presents the results of a preliminary determination of the feasibility of exploiting the energy potential of resource recovery to attract new industry to the Catawba County area. This determination involved the evaluation of the existing market potential for energy recovery; an assessment of the opportunities and obstacles to using resource recovery as an industrial development catalyst; development and comparative evaluation of various resource recovery alternatives; and identification of major tasks to be performed prior to deciding to implement a resource recovery project.

These activities reflect the results of three site visits to Catawba County by CSI Resource Systems, Inc., and interviews with County personnel and four major industrial, institutional, and utility energy users in the area.

Resource Systems is a technical assistance contractor to the Office of Solid and Hazardous Waste, U.S. EPA Region IV. Under the terms of the Technical Assistance and Panels Program, all of Resource Systems' technical assistance activities on behalf of Catawba County were paid for by the EPA.

Resource Systems wishes to thank especially T. Jack Matthews, Director of Catawba County Construction and Engineering, and Richard Stroupe, Executive Director, Catawba County Industrial Development Commission.

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CHAPTER 1. PRELIMINARY EVALUATION OF RESOURCE RECOVERY AS AN INDUSTRIAL DEVELOPMENT CATALYST FOR CATAWBA COUNTY, NORTH CAROLINA

OVERVIEW

Analysis has been performed to determine the feasibility of utilizing resource recovery as an incentive for industry to locate new facilities in Catawba County, North Carolina. Based on Catawba County's request for technical assistance, initial efforts were directed toward determining the technical and economic feasibility of converting the area's solid waste resources into process grade steam for sale to one or more of the area's major industrial or institutional energy consumers. (See Appendix for project background).

The results of an energy market survey conducted to identify potential customers for resource recovery steam, concluded that no viable energy customers, currently exist. As a result of this finding, technical assistance efforts were refocused to evaluate the concept of utilizing energy resource recovery as an industrial development catalyst.

The remainder of this report discusses the selection of a technically suitable resource recovery alternative for Catawba County; an economic evaluation of that option based on the premise that a suitable energy market can be secured; the obstacles and opportunities associated with the concept of exploiting resource recovery as an industrial development catalyst and steps the County can take toward project implementation once a suitable energy market is identified.

ANALYTICAL APPROACH AND PRINCIPAL FINDINGS

The analysis performed in determining the feasibility of resource recovery for Catawba County, North Carolina reflects the fact that the successful implementation of resource recovery is dependent upon the following ingredients:

1. The existence of one or more potential energy customers whose energy requirements are compatible with the energy that can be produced from a resource recovery facility.

2. The availability of a sufficient tonnage of processible solid waste from which energy can be produced to meet the requirements of the potential energy customer(s).

3. The existence of technologies that can process the available waste and reliably produce energy in the form, quantity and quality required by the prospective customer(s).

4. The existence of potentially available sites for a recovery facility that appear to be environmentally satisfactory and are well situated with respect to the shipment of solid waste and the delivery of energy to prospective customers.

5. Net annual cost estimates over the life of the recovery facility that appear to be reasonably competitive with continued reliance on landfilling as the primary means of disposal of solid waste.

Principal findings resulting from the analysis performed in support of the Catawba County technical assistance effort, indicate that:

- Catawba County generates and controls sufficient solid waste to support the materials requirements of a technically feasible resource recovery project.

- However, no viable customers for resource recovery energy currently exist. Thus, the successful implementation of resource recovery will likely require the identification and recruitment of a suitable candidate market.

- A number of industrial type entities have been identified which have compatible energy requirements and for which resource recovery energy could be a strategic and cost competitive alternative energy source.

- The economics of a resource recovery facility serving the disposal needs of Catawba County could be cost-competitive with the alternative of continued primary reliance on landfilling, provided a suitable energy market can be secured.

The following section discusses the results of an energy market survey conducted to identify potential customers for resource-recovered energy.

CHAPTER 2. POTENTIAL ENERGY MARKETS

Seven large industrial or institutional energy consumers located in Catawba County were initially identified as possible candidates for resource recovered energy. Telephone conversations were held with each candidate to assess the size and variability of their energy demand, their ability to use resource recovered energy, their interest in resource recovery and the availability of a nearby site. Based on preliminary indications of suitability, follow up telephone conversations and personal interviews were conducted with representatives from four of these entitites: Catawba Memorial Hospital, Clyde Fabrics, General Electric, and the City of Newton Municipal Utility.

While each entity expressed interest in the concept of purchasing resource recovered energy, various factors indicated that none of these candidates should be considered further as feasible energy markets. Catawba Memorial Hospital, Clyde Fabrics and General Electric, have modest and variable steam energy requirements, which would result in a low utilization factor and hence, unattractive economics for any resource recovery facility serving these markets. The Newton Municipal Utility could purchase the entire electric energy potential of Catawba County's solid waste. However, because the area currently enjoys low priced electricity due to Duke Power's high coal and nuclear capacity, the revenues resulting from the production and sale of electricity would be insufficient to justify the capital investment in an electricity generating resource recovery facility.

A brief discussion on the energy practices of these four entitites is presented below.

CATAWBA MEMORIAL HOSPITAL

Background

Catawba Memorial Hospital is a 220-bed, acute-care hospital, serving the Hickory/Catawba County area.

Energy Practices

The hospital utilizes two 500-horsepower, natural-gas-fired boilers, to produce low-pressure steam for heating, laundry and other hot water applications. Recently implemented conservation practices have been successful in significantly reducing steam consumption. For instance, a newly installed heat reclaim system, (estimated capital cost of $75,000) has allowed the hospital to replace its steam absorption air conditioning system with a smaller-sized electrically powered centrifugal-type system. Previously, winter air conditioning was provided by a 250-hp absorption chiller and summer air conditioning of 650 tons. With the heat reclaim system, winter air conditioning is eliminated and summer is reduced to 450 hp. The expected payback on this equipment is projected at less than one year.

A second conservation effort which will reduce steam consumption is the practice of reducing steam pressure. Previously, steam was produced at a constant 125 psi. Now steam is produced at 100-110 psi during the weekday first shift (when laundry is washed) and further reduced to 60 psi during weekends and weekday 2nd and 3rd shifts.

In 1980, average hourly steam consumption ranged from 3,100 (summer) to 6,700 (winter) pounds per hour. It should be noted that 1981 steam consumption is likely to be reduced from 1980 levels, reflecting the recently implemented conservation measures.

Implications for Resource Recovery

Although representatives of the Hospital expressed interest in the concept of purchasing resource recovered steam and nearby suitable sites exist to locate such a facility, the Hospital's modest and variable steam demand indicates that this market is not economically viable.

CLYDE FABRICS

Background

Clyde Fabrics, located in Newton, is a division of TiCaro, the world's largest producer of knit gloves. The Newton facility produces fabric

for work gloves; the other TiCaro facilities, in addition to work gloves, produce sweat suits as well as various knit and yarn products on a commission basis. The Clyde Fabrics plant is an older facility. Although located in a residential area of Newton, the facility is only three blocks from a Carolina Mills manufacturing facility (Plant #4). Under current economic conditions, the plant has been operating 3 shifts per day on a 6-day basis. Recent substantial capital investment indicates that TiCaro expects to continue operating this facility in the near term.

Energy Practice

Clyde Fabrics produces low-pressure process steam (110 psi) for fabric dyeing, hot water applications, and for heating portions of the building in the winter months. Plant personnel estimate that approximately 10-15% of the steam produced is recaptured in the form of condensate return. Because much of the steam comes in direct contact with the fabric, it is difficult to increase substantially the quantity of condensate return. As a result, substantial quantities of warm water are discharged into the city sewer system. Current conservation plans call for an evaluation of various methods to exploit the energy potential of the warm water prior to discharge.

Natural gas, purchased on an interruptible basis from Piedmont Natural Gas Company, is the primary boiler fuel.

Based on recent gas consumption data and a 6-day, 24-hour operating schedule, it appears that Clyde Fabric's average hourly steam requirements range from 8,000 pounds in summer to 15,000 pounds in winter.

Implications for Resource Recovery

Management appears very open to the concept of resource recovery. Critical concerns which it feels must be addressed are reliability and cost-competitiveness (i.e., that the cost of buying steam not exceed the cost of producing its own steam).

Because of modest and somewhat variable steam requirements, however, it does not appear that Clyde Fabrics can be considered as a viable primary market for resource-recovered steam. Should it be found that the nearby

Carolina Mills Plant # 4 has energy practices compatible with Clyde Fabrics, consideration may be given to the concept of providing steam simultaneously to both facilities. One possible impediment to this arrangement might be the availability of nearby land to site a resource recovery facility in this somewhat residential area.

GENERAL ELECTRIC

Background

The Hickory General Electric facility is part of the company's distribution/transformer, strategic business unit. This facility, which covers some 160,000 square feet, has been located in Hickory for about 25 years. At current production levels the plant operates 5 days-per-week, 3 shifts per day. As the market for transformers is mature, no significant future growth is envisioned at this facility.

Energy Practices

The facility is a major electricity consumer with average monthly use of about 4,000,000 kWh. Electricity is used for lighting, driving machinery, firing furnaces, and during the winter to heat the newest part of the plant (approximately 100,000 ft^2).

The facility also utilizes medium-pressure process steam (250 psi) for various manufacturing applications, including steam-heated ovens, for drying and annealing, washing and cleaning. Steam is also used during the winter to heat the 60,000-foot area of the original plant. The facility employs three 40,000-lb-per-hour natural-gas-fired boilers. Natural gas is purchased on an interruptible basis from Piedmont National Gas Company. Number 6 fuel oil is backup fuel. In recent years, natural gas has represented 85-90% of the fuel consumption with fuel oil the remainder

In 1980, General Electric's average hourly steam consumption ranged from a low of 5,400 pounds in June to a high of 26,600 pounds in December.

Implications For Resource Recovery

Several positive factors are cited relative to General Electric's suitability as a market for resource-recovered steam: its management appears open-minded to resource recovery's potential; the facility currently depends upon increasingly expensive natural gas a fuel source; and several nearby sites owned by G.E. may be suitable for locating a resource recovery facility. G.E.'s modest and variable steam demand, however, can accommodate only 20 percent of the energy potential of the area's solid waste. Therefore, the production of steam for sale to G.E. is unlikely to be economically feasible.

CITY OF NEWTON MUNICIPAL UTILITY

Background

Newton Municipal Utility purchases power on a wholesale basis from Duke Power, and subsequently distributes and sells electricity on a retail basis to residential, commercial, and industrial accounts in the Newton/Catawba area. Current distribution capacity is 16.5 MW; plans for a new distribution subsystem to be located west of Newton will result in a doubling of existing capacity. The current wholesale cost to the Newton Municipal Utility ranges from 27.5 to 28.8 mils (2.75-2.88¢). As the last request increase (October 1980) by Duke Power was limited to 5-7%, it is expected that a scheduled increase, effective October 1, 1981, will be in the range of 19%.

Implications For Resource Recovery

The modest per kWh revenues (i.e., projected at no more than 34 mils) to be realized from the sale of electricity produced from a resource recovery facility indicates that electricity production for sale to the Newton Municipal Utility is only viable if a primary steam energy customer can be secured. With a primary steam market, the concept of cogenerating steam and electricity with electricity sold to the municipal utility could have economic merit.

The absence of a compatible energy market generally means that the concept of resource recovery is not feasible. However, Catawba County recognizes the potential of resource recovery as an industrial development catalyst. Assuming that a viable energy market can be secured, the feasibility of resource recovery then depends upon the sufficient solid waste, appropriate technology, available site, and cost-competitive economics.

The following sections address these issues.

CHAPTER 3. TECHNICAL FEASIBILITY OF RESOURCE RECOVERY

Provided a suitable energy market can be secured, the technical feasibility of resource recovery requires sufficient tonnage of processible waste, the existence of suitable technology and an available site to locate the facility. This section discusses the technical feasibility of resource recovery based on Catawba County's circumstances.

SOLID WASTE RESOURCES

Preliminary indications are that Catawba County generates and controls between 300 and 400 tons per day of solid waste. Based on an assumed per-capita generation rate of 4 pounds per capita per day, the Catawba area generates approximately 73,000 tons per year or 203 tons per day, on a 7-day-per-week basis. Table 1 presents calculations performed to estimate the County's annual and daily waste generation.

SUITABLE TECHNOLOGY

Two commercially demonstrated technologies to convert MSW into process-grade steam (the preferred energy form given Catawba's circumstances) and suitable to accommodate the County's modest solid waste generation are massburn incinerators with waste heat boilers and modular combustion-unit type systems.* To date, the massburn-type systems have been utilized for large-scale projects ranging in design capacity from 600 to 1,200+ tons per day (TPD), while MCU systems usually have been employed for projects in the 50-to-300-TPD range. Because of higher operating efficiencies vis-a-vis MCU systems, massburn-type technology is now being considered for small-scale projects as low as 200 TPD, particularly in circumstances where premium-priced fuel oil is the displaced fuel.

For the purposes of the preliminary analysis, however, the analysis to determine concept economic feasibility is based on the less costly MCU technology. The following section briefly describes the MCU technology.

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* Massburn resource recovery systems are of two types: refractory-walled or water-walled.

TABLE 1
WASTE GENERATION CALCULATIONS

ASSUME:

- 4 lbs/capacity/day
- 100,000 population
- Resource recovery system operates 50 weeks/year

CALCULATIONS:

$$\frac{4.0 \text{ (lbs/capita/day)} \times 100{,}000 \text{ (pop)} \times 365 \text{ (days)}}{2000 \text{ lbs/ton}}$$

73,000 Tons Per Year

$$\frac{73{,}000}{50 \text{ weeks} \times 5 \text{ days}} = 292 \text{ TPD}_5$$

$$\frac{73{,}000}{50 \text{ weeks} \times 6 \text{ days}} = 243 \text{ TPD}_6$$

$$\frac{73{,}000}{50 \text{ weeks} \times 7 \text{ days}} = 209 \text{ TPD}_7$$

Modular Combustion Technology

Steam markets with low demand (20,000-80,000 pounds of steam per hour) and, thus, small processing requirements for solid waste (100-400 TPD), can be served by MCUs, which are pre-engineered, factory-assembled systems. MCUs equipped for solid waste processing, energy recovery, and continuous ash removal are available in individual unit sizes ranging from 10 to 75 TPD.

Figure 1 provides a simplified diagram of an MCU which is typical of many of the designs offered. As shown in this figure, waste is delivered to the resource recovery facility, onto a concrete unloading floor. Unprocessible materials (e.g., large metal objects, water heaters, rugs) are removed and placed in residue containers for sale as scrap or for disposal in a landfill. A front-end loader is used to push the remaining solid waste into a hopper, and a hydraulic ram-feeder moves the waste into the incinerator's lower chamber where it is partially burned. The heat released provides the energy needed to dry and gasify the remaining waste. The carbon-monoxide-rich smoke leaves the top of the lower chamber and enters the secondary chamber; there, more air is added, and the gases are burned to completion. As the hot gases exit the secondary chamber, they pass through a heat exchanger, where the heat in the exit gases is converted to steam. The stack gases are then discharged to the atmosphere.

Ash consisting of glass, stone, metals, inert solid waste, and uncombusted organics is moved from the bottom of the lower chamber into an ash quenching and disposal system. A magnet that recovers magnetic metals for sale to the secondary metal market can be installed. The remaining ash is loaded into a truck for disposal at a landfill.

An MCU system with a rated design capacity of 300 TPD, comprised of four 75-TPD modules, was determined to be one possible system alternative to accommodate the estimated 73,000 tons of MSW generated annually in Catawba County.* Resource recovery systems typically operate 24 hours per day, 5 to 7 days per week, depending upon the energy requirements of the designated energy customers. If operating 6 days per week, the

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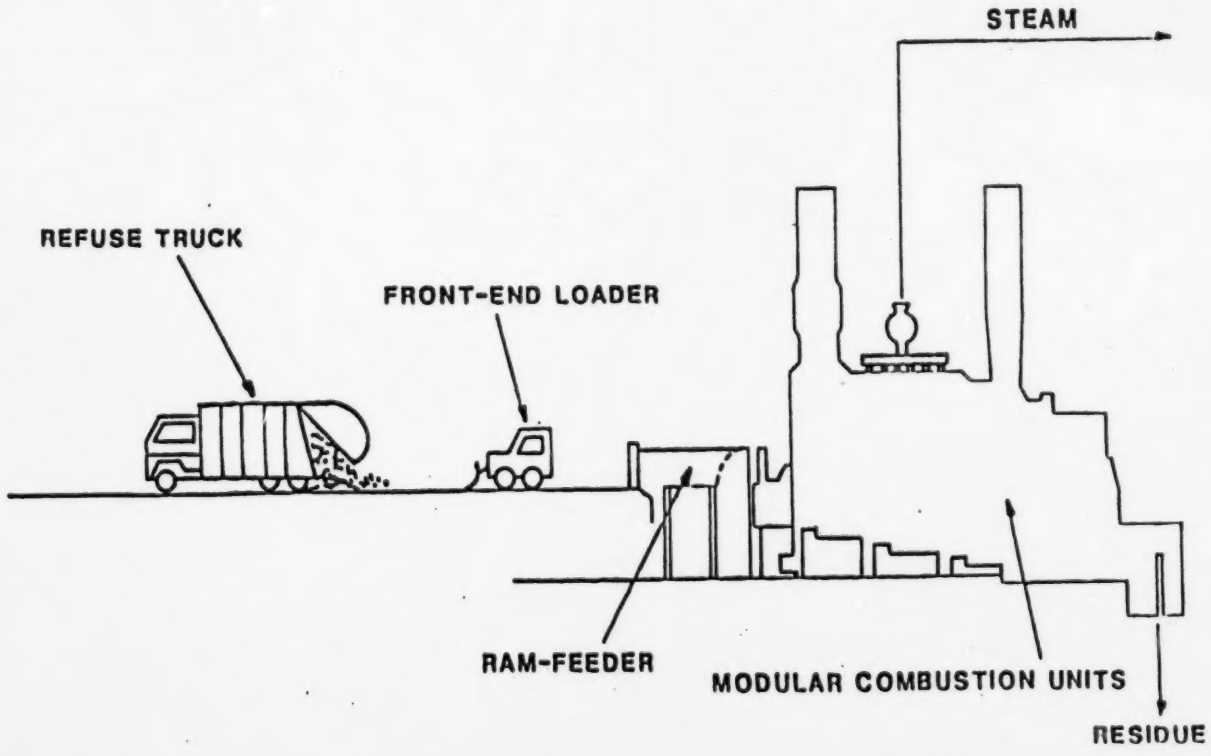
* Other possible system configurations are six 50-TPD modules for MCU technology or two 150-TPD boilers for massburn-type technology.

FIGURE 1.

MODULAR COMBUSTION UNIT



facility would process approximately 243 TPD (50-week basis). For the sake of the economic analysis which follows in the next section, the assumption is that the resource recovery system evaluated operates 6 days per week.

CHAPTER 4. ECONOMIC FEASIBILITY

As previously indicated, in order for resource recovery to be feasible a number of ingredients must exist, including cost competitiveness. Cost competiveness is determined by comparing the projected cost of disposal under resource recovery with the likely cost of the County's other solid waste disposal alternatives.

The remainder of this section discusses the methodology used to assess the economic feasibility of resource recovery for Catawba County.

Current Disposal Practices and Costs

Catawba County owns and operates two landfill disposal facilities. The oldest of these facilities is located near Newton in the southeastern section of the County. The newest facility was recently implemented and is located in the western part of the County. Although the older facility has substantial remaining life, the County secured a second landfill in order to minimize waste hauling costs and to ensure that the County would have long term disposal capacity. Because of the recent major changes in solid waste disposal circumstances, current per ton disposal costs are difficult to estimate. For the sake of this analyis, it was assumed that current per ton disposal costs associated with operating both facilities, will be in the $7.00 range* and that future costs will increase by approximately 10% per year.

Projected Economics for Resource Recovery

The projected economics for a 300-TPD modular combustion system (MCU), operating 6 days per week and producing low-pressure process steam for an as yet unknown industrial concern, indicate 1985 (the assumed first year of commercial operations) per-ton disposal costs in the $14 to $21 range, and 1989 (the fifth year of operation) per-ton costs in the $9 to $17 range, depending upon financing methods used. This figure compares with a 1985 projected cost of disposal under continued landfilling of approximately $10.00 per ton and a 1989 estimated cost of $15 per ton.

---

* The 1981 per-ton cost of operating environmentally complying landfills in the size range of Catawba County's facilities can range as low as $4.00 to $6.00 per ton and as high as $12.00 to $16.00 per ton.

The summary of projected economics and supportive documents contained in Tables 2 through 5 indicate the following conclusions:

- Provided a suitable energy customer can be secured, resource recovery appears to be a potentially competitive solid waste disposal alternative for Catawba County.

- The economic feasibility of resource recovery requires a high system utilization factor (i.e., the system operates 6 days per week and processes waste equivalent to at least 90 percent of its nominal design capacity), and the purchase of at least 80% of the steam energy output by the designated energy customer.

- The economics of resource recovery are influenced by the financing method; the combination of partial equity provided by the system vendor/developer and IRB financing results in the lowest debt service component and hence lowest net disposal costs for all three evaluated options.

Assumptions

A number of assumptions were used in developing the economic projections discussed above.

The following summarizes the major assumptions:

- Resource recovery facility becomes operational in 1985.

- Costs, including capital and operating, escalate at 10 percent per year compounded.

- Financing terms are: 17 years at 11 percent for IRB and Equity/IRB options; 17 years at 10 percent interest for GOB options.

- Energy revenues are predicated upon fuel displaced value of 150 psi steam (at assumed boiler efficiency of 85 percent and 25 percent condensate return at 100^{o}F), less 10 percent discount to energy customer. Fuel oil prices increase by 10 percent/yr, hence steam revenues increase by 10 percent annually.

- For the 300 TPD MCU resource recovery facility envisioned, it is assumed that 90% of the steam produced is purchased by energy customer.

- Under equity/IRB financing, 25 percent of system capital cost is invested as equity by system developer/ vendor in return for the benefits of ownership (i.e., investment tax credit and accelerated depreciation).

The following tables reflect calculations and analyses used to develop the economic projections in this report.

Table 2 presents the total financing requirements for a 300-TPD Modular Combustion Unit (MCU), (one technically viable resource recovery option for Catawba County) under three financing alternatives: Industrial Revenue Bond (IRB), General Obligation Bond (GOB), and a combination of 25 percent equity and IRB. In addition to equipment capital costs, the options also entail costs for engineering and legal assistance; capitalized interest to meet bond paymets during the construction and startup periods, but before revenues are generated; start-up expenses, a debt service reserve fund (most resource recovery projects financed under IRB require a minimum of one year of reserved capitalized debt service payments to protect bondholders); and bond underwriting costs.

Tables 3-5 present the cost elements associated with the operation of the referenced resource recovery system under each of three financing alternatives. As the analysis indicates, factors affecting the net disposal cost (i.e., per-ton cost of disposal) are:

- Solid waste throughput
- Quantity of energy sold
- Financing method.

TABLE 2
FINANCING REQUIREMENTS: 300-TPD MCU

COST ELEMENTS	FINANCING METHOD ($000's) GO[1]	IRB[2]	25%Equity/IRB[2]
A. Capital Cost	11,600	11,600	11,600
B. Engineering/Legal	400	400	400
Less: Equity Contribution	-	-	3,000
SUBTOTAL	12,000	12,000	9,000
C. Capitalized Interest	1,478	2,182	1,527
D. Allowance for Startup	400	400	400
E. Debt Service Reserve	-	2,470	1,850
F. Bond Financing[3]	139	528	395
TOTAL BOND ISSUE	14,017	17,580	13,174
TOTAL FINANCING REQUIREMENTS	14,017	17,580	16,174

1. GO Financing = 17 years at 11% annual interest rate
2. IRB and Equity/IRB Financing = 17 years at 12% annual interest rate
3. Bond Financing Costs = 1% for GO, 3% for IRB and Equity/IRB.

TABLE 3

PROJECTED ECONOMICS FOR 300-TPD MCU

(INDUSTRIAL REVENUE BOND FINANCING)

Annual Solid Waste Throughput (Tons)	73,000
Annual Energy Sales (Pounds of Steam)	295,650,000

Expense Item ($/Ton)	Operating Year 1(1984)	6(1989)
Debt Service	33.83	33.83
O&M	15.00	24.16
Residual Disposal	3.00	4.83
Operator's Fee	3.00	4.83
SUBTOTAL	54.80	67.65
Revenues/Income ($/Ton)		
Steam	28.80	46.38
Debt Service Reserve Earnings	4.74	4.74
SUBTOTAL	33.54	51.12
Required Tip Fee ($/Ton)	21.29	16.53
PROJECTED TOTAL DISPOSAL COSTS ($000's)		
Continued Landilling	680	1,096
Resource Recovery	1,554*	1,207*

* Includes cost of operating backup landfill for unprocessed materials and plant residues.

TABLE 4
PROJECTED ECONOMICS FOR 300-TPD MCU
(GENERAL OBLIGATION BOND FINANCING)

Annual Solid WAste Throughput (Tons)	73,000
Annual Energy Sales (Pounds of Steam)	295,650,000

Expense Item ($/Ton)	Operating/Year 1(1984)	6(1989)
Debt Service	25.44	25.44
O&M	15.00	24.16
Residual Disposal	3.00	4.83
Operator's Fee	3.00	4.83
SUBTOTAL	46.44	59.26
Revenues/Income ($/Ton)		
Steam	28.80	46.38
Debt Service Reserve Earnings	-	-
SUBTOTAL	28.80	46.38
Required Tip Fee ($/Ton)	17.64	12.88
PROJECTED TOTAL DISPOSAL COSTS ($000's)		
Continued Landfilling	680	1,096
Resource Recovery	1,288*	940*

* Includes costs of operating backup landfill for unprocessed materials and plant residues.

TABLE 5
PROJECTED ECONOMICS FOR 300-TPD MCU
(75% IRB, 25% EQUITY FINANCING)

Annual Solid Waste Throughput (Tons)	73,000
Annual Energy Sales (Pounds of Steam)	295,650,000

Expense Item ($/Ton)	Operating Year 1(1984)	6(1989)
Debt Service	25.35	25.35
O&M	15.00	24.16
Residual Disposal	3.00	4.83
Operator's Fee	3.00	4.83
SUBTOTAL	46.35	59.17
Revenues/Income ($/Ton)		
Steam	28.80	46.38
Debt Service Reserve Earnings	3.55	3.55
SUBTOTAL	32.35	49.93
Required Tip Fee ($/Ton)	14.00	9.24
PROJECTED TOTAL DISPOSAL COST ($000's)		
Continued Landfilling	680	1,096
Resource Recovery	1,022 *	675*

* Includes cost of operating backup landfill for unprocessed materials and plant residues.

CHAPTER 5. RESOURCE RECOVERY AS AN INDUSTRIAL DEVELOPMENT CATALYST

This section discusses the obstacles and opportunities associated with the concept of using resource recovery as an industrial development catalyst.

As previously stated, a successful resource recovery project requires at a minimum: available waste, a viable energy market, an available site, a technology to process the waste and meet market requirements, and viable economics. While all of these factors must be assessed in tandem to reach a determination of project feasibility, without an attractive and technically feasible energy market, no project opportunities exist, even if the other necessary elements are there. As a consequence, while a community's intention to build a resource recovery facility (i.e., a local source of reliable and economical energy) may be attractive to an industry seeking to locate a new plant, a community can not realistically make a decision to implement resource recovery until it is assured of a firm commitment from the energy customer to purchase waste-derived energy at a price that will afford sufficient revenues to the project such that project economics are viable.

A community that is committed to the concept of resource recovery, but is lacking a viable energy market, can work with its industrial development commission* or similar entity to try to attract a potentially compatible industry to the area. An opportunity to obtain this alternative energy supply could be an important catalyst in an industry's decision on where to locate. Any commitment to resource recovery must, however, be understood as contingent on: first, being able to meet an industry's energy requirements; and second, economic viability.

In building a resource recovery facility to service a new industry, scheduling considerations arise. For example, if from the point of deciding to go ahead with resource recovery, 3 years were required to reach the point of facility operations, whereas only 2 years were required to build the new industrial plant, construction of new industrial plant could be

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* Based on conversation with the Executive Director of Catawba County's Industrial Development Commission, the County is commited toward attracting new industry to expand the area's industrial base.

delayed 1 year to make the schedules compatible, or the industry could build a temporary power plant for use until the recovery facility became operational and thereafter for standby purposes.

This approach to project development requires "good-faith" negotiations between the community and the propsective energy market as the host community can not commit to a project until it can be satisfied that the project is both technically and economically feasible and environmentally sound

The remainder of this discussion addresses the energy profile of desirable market candidates. Table 5-1 is an exemplary list of types of industries whose energy requirements are typically compatible with resource recovery.

Overall Energy Demand

A desirable energy customer is able to use all of the energy that the resource recovery facility produces. If the energy buyer relies entirely on the resource recovery facility, the facility will have to include its own standby capability (typically oil- or gas-fired package boilers). The cost of this standby capacity will increase moderately the capital cost of the resource recovery facility. If the energy buyer's requirements exceed the output of the resource recovery, it will have to maintain in-house energy production units to meet this excess, which could also be used when the recovery facility is down for scheduled maintenance or other reasons.

In order for a resource recovery facility to be economically viable, the energy customer must be able to purchase a minimum quantity of energy on a reasonably continuous basis. Experience with numerous resource recovery facilities indicates that the minimum energy consumption necessary to support a resource recovery facility is equivalent to approximately 25 million Btus* per hour on a three-shift basis (24 hours per day) at least 5 days per week (but preferably 7 days per week). Thus, the most desirable energy customer is one who has a constant energy demand, operates on a continuous basis, and has requirements that equal or exceed the output of the resource recovery facility.

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* This figure represents approximately 17,000 lbs/hr of process-grade steam.

TABLE 5-1

EXAMPLES OF TYPICAL INDUSTRIES WITH ENERGY REQUIREMENTS COMPATIBLE WITH RESOURCE RECOVERY

Brick Manufacturing

Chemical Processing

- Asphalt Manufacture
- Petrochemical Refinery
- Pharmaceutical

Commercial Laundry

Food Processing

- Brewery
- Bottling Plant
- Candy Manufacture
- Distillery
- Frozen Food Manufacture
- Grain Processing
- Meat Packing/Processing

Leather

- Finishing Plant
- Tannery

Pulp and Paper

- Paperboard Manufacture
- Paper Converting
- Pulp Mill

Rubber

- Tire Manufacture
- Tire Recapping

Textile

- Textile Dryer
- Textile Finisher

Tobacco

- Tobacco Manufacture (cigarette, cigar)

Assorted Heavy Manufacturers

- Automobile Assembly
- Truck Assembly
- Farm Implements

Seasonal variability in process or heating steam demand can be accommodated by a cogeneration facility. Cogeneration (the addition of a turbine-generator to the system to produce electricity while extracting steam for sale) provides a means of operating at a constant output even when the steam user has a high seasonal variability.

Fuel Use Alternatives

The objective of selling energy derived from solid waste is to displace the fuels used by the customer. In the case of a new industry, the resource recovery facility would have to offer this energy at a price lower than that which the customer would have to pay for alternative available fuels. Therefore, the most attractive industrial buyer would be one that would otherwise be using oil or gas.

Displacement of oil would likely provide the highest energy revenues to the project and the greatest energy savings to the customer. If the displaced oil is low-sulfur in content, the potential energy savings to the customer will likely be the greatest. Conversations with North Carolina State University personnel indicate that any new oil-fired power plant for a manufacturing concern would probably have to use low-sulfur oil because of current air quality standards.

While natural gas is still less expensive than No. 6 oil, it is likely that by 1985, on an energy-parity basis, natural gas prices will be equivalent if not higher than those for No. 6 oil.

Coal is currently a substantially less expensive fuel and is readily available in the southwest. However, the capital and operating costs associated with a coal-fired power plant typically require that the industrial concern be raising at least 200,000 pounds of steam per hour before this approach can be economically justified. Currently, there are few resource recovery plants that can compete economically with a coal-fired plant, such that displacement of coal by waste-derived energy is unlikely.

CHAPTER 6. STEPS TOWARD IMPLEMENTATION

The results of this preliminary feasibility study indicate that four of the five necessary ingredients to the successful implementation of resource recovery are present; provided a suitable energy market is secured Catawba County can pursue project implementation. Because a suitable energy market has not been identified and the technical evaluation and economic evaluation of resource recovery contained in this report is preliminary, a number of tasks must be performed and issues resolved before the committment to implement any particular resource recovery system is made. Specifically, before committing substantial additional resources to a project, Catawba County must first identify a suitable energy customer and then determine that customer's level of commitment to the purchase of resource recovered energy. As well the County must determine more precisely: the quantity of processible waste available, its energy content, and seasonal fluctuations in quantity and quality; and current control of the waste streams. After these determinations have been made, the county will be able to make informed decisions about implementing a specific project. If the county decides to implement a project, it will be necessary to resolve a number of issues (e.g., sponsorship, risk allocation, procurement financing, optimal system design, legal and institutional problems) before moving ahead with implementation.

In this chapter, the immediate next steps to be taken are outlined, and the remaining issues are discussed.

IMMEDIATE NEXT STEPS

Before a final decision is made to implement a resource recovery project, three tasks must be performed. Each is discussed in the following subsections.

Identify Suitable Energy Customer and Verify Its Level of Commitment To the Purchase of Resource Recovered Energy

The preliminary energy market survey indicates that no suitable energy customer currently exists. As a consequence, potential customers for resource-recovered energy must first be identified (possibly through the county's ongoing industrial recruitment efforts). Assuming such a candidate(s)

can be identified, the County must meet with the prospective energy customer to discuss in detail its energy requirements, its willingness to commit to long-term contracts for the purchase of recovered energy and its possible interest in equity participation in a project.

Determine Quantity and Energy Content of Available Waste

A preliminary estimate of the quantity of solid waste available in Catawba County has been made based on reasonable per capita waste generation, factors. However, considerable additional work is needed in this area. Specifically, a weighing program should be established at each of the County's two landfills to determine the quantity of solid waste generated in Catawba County. In addition, waste sampling programs should be conducted at both landfills to estimate what portion of total waste generation is processible and the energy content (i.e., HHV) of the processible waste. Finally, the seasonal fluctuations in waste quantity and quality should be established.

Develop Strategies for Waste Control

Although solid waste collection and disposal practices in the County has been reviewed, a more detailed analysis of collection and disposal is needed. From this analysis, it should be possible to determine the extent to which the County has the right to decide where waste is to be disposed and, thus, to assess the risk that a resource recovery project would not receive all of the waste expected. Catawba County can then develop appropriate waste control strategies, to ensure that processible waste will be directed to the resource recovery facility.

IMPLEMENTATION ISSUES

If the results of the steps detailed above confirm the preliminary feasibility of resource recovery and a decision is made to implement one or more projects, a number of issues will need to be addressed prior to implementation. Many of these issues are interrelated and cannot be considered totally independent. Therefore, to resolve these issues,

it will be necessary to address several of them simultaneously, rather than consecutively. The issues include:

- Who will sponsor the project?
- How should project risks be allocated?
- What procurement method should be used?
- What financing method is most appropriate?
- What is the optimal system design?
- What are the legal and institutional barriers to implementation, and how can they be overcome?

In the following subsections, each of these issues is examined, to highlight the major factors to be considered in resolving it.

Project Sponsorship

A decision must be made as to what entity will sponsor the resource recovery project. For a project serving Catawba County, possible sponsors include: a special authority created for the project or a single entity that can assume sponsorship responsibility (e.g., Catawba County or the Catawba County Industrial Development Commission).

The creation of a special authority has certain advantages over sponsorship by an existing entity. In most states, a specially created solid waste management authority is not subject to competitve bid requirements of construction and, thus, can adopt the most appropriate procurement method, select the most qualified system vendor through negotiated bidding, and negotiate long-term contracts for solid waste delivery and system operation. The major limitation of sponsorship by a specially created entity is its lack of taxing authority, which limits financing options to IRBS or equity and IRBs.

Allocation of Project Risks

Unlike public works projects normally undertaken by local governments, resource recovery projects are risky, chiefly because:

- Recovery technology is not fully proven.
- Waste volumes and composition are variable.
- Operating experience is limited.
- Product user requirements are stringent.

These factors give rise to specific risks in four areas:

1. Project economics (e.g., lifetime operating and maintenance costs, lifetime product revenues, capital costs, lifetime net disposal costs).
2. Marketing (e.g., user requirements, user investments, product prices, contract duration).
3. System performance (e.g., product quality, recovery efficiency, processing capacity, reliability, residual disposal requirements).
4. Waste stream (e.g., volume changes, composition changes, payment of disposal fees).

The sponsoring entity must evaluate each area of risk and determine which participant in the project is best able to assume and manage a particular risk. For example, the project sponsor can deal with the risk that a minimum daily tonnage will fial to be delivered to the project. By contrast, the system vendor/operator can best deal with the risk that the system will not be able to process the amount of waste it was designed to handle.

In general, the system vendor can best deal with the economic and technical risks associated with the project's technology. The project sponsor will need to devise mechanisms to ensure that the system vendor assume these risks. System vendors are often asked to provide contractual guarantees of system performance and economics (e.g., processing capacity, recovery efficiency, plant reliability and availability, product quality, O&M costs). In return, the vendor receives a service fee that compensates for the risks assumed.

Procurement Approach

There are three methods of procurement used for resource recovery projects:

- An architectural and engineering (A&E) contract, which is customary for facility design and equipment selection, preparation of competitive bid specifications, construction supervision, and, possibly, facility shakedown. Construction and equipment installation are competitvely bid. Full-scale operation and, possibly, shakedown are the responsibility of the public owner.

- A turnkey approach, in which a single entity performs the services that would otherwise be provided by an A&E, plus construction, testing, and shakedown of the system. Payment is made to the turnkey contractor following successful shakedown and acceptance by the public sponsor. Full-scale operation is the responsibility of the public owner.

- A full-service approach, in which a single contractor performs all functions of a turnkey contractor and is responsible for full-scale operation of the facility (generally ranging from 5 to 20 years).

The following table summarizes the extent to which various project risks can be transferred from the public sector to private industry under the three procurement approaches:

Key Project Risks	A&E	Turnkey	Full Service
Project economics	None	Limited	Substantial
Marketing	None	None	Substantial
System Performance	Very Limited	Limited	Substantial
Waste Stream	None	None	Limited

The full-service approach vests the maximum degree of control in the vendor and, thus, offers the greatest opportunity for transferring risks to the vendor. The sponsoring entity can transfer maximum of risk to the full-service vendor/operator by obtaining contractural guarantees for the system's technical and economic performance.

Financing Method

Resource recovery projects in the United States have typically been financed with tax-exempt GOBs or IRBs, but, as a result of recent changes in tax laws, resource recovery system vendors, developers, financing entities, and industrial concerns (i.e, energy customers) are increasingly interested in assuming constructive ownership of a resource recovery facility. Constructive ownership affords substantial tax benefits (i.e., investment tax credits, depreciation tax shield). Internal Revenue Service (IRS) requirements for constructive ownerhsip can be satisfied by making an equity contribution to the proper project or by assuming responsibility for its total debt service obligations.

In making the preliminary determination that a resource recovery facility serving Catawba County can be feasible provided a suitable steam energy customer can be secured, economic feasibility was examined under three financing methods: 100-percent IRB, 25-percent equity and 75-percent IRBs, and 100-percent GOB (see Chapter 4). As was illustrated in Tables 2 through 5, the choice of financing method has a major impact on the economic attractiveness of a given resource recovery project. However, in addition to economic impacts, each financing method offers several benefits that must be considered in selecting an appropriate financing method, as outlined in the following paragraphs.

IRB Financing. Tax-exempt IRBs are commonly used to finance resource recovery projects. Because project revenues (i.e., energy revenues and disposal fees) are the only sources of funds to retire IRBs, a rigorous analysis of project economics is required, to ensure that revenues will

be sufficient. Hence, the effect of IRB financing is to ensure that any project implemented is fully justified on its economic merits. In addition, IRBs do not reflect on the debt capacity of the issuing entity, because the funds are borrowed on a project basis.

Equity/IRB Financing. Under this financing method, a partial equity contribution is made by a private investor (e.g., the energy customer, the system vendor, the project developer), and the balance of funding is obtained through IRBs. The equity contribution reduces the bond issue requirement and provides significant tax advantages to the private investor. Depending on the investor's tax bracket, the timing of the investment tax credit, and the deprecation period and method used, the net present value of the tax benefits resulting from a 25-percent equity contribution can represent an after-tax return on investment of 25 to 30 percent. However, to realize such a return, the equity contribution must be made by an entity that can utilize the tax benefits, i.e., a profitable concern with taxable income to shelter. In addition, the equity contribution vests project ownership with the private investor and, for practical purposes, requires private operation of the facility.

GOB Financing. Like IRBs, tax-exempt GOBs are commonly used to finance resource recovery projects. In addition to project revenues, the full faith and credit of the sponsoring entity are pledged to retirement of GOBs, so taxing mechanisms may be used to meet obligations in the event that project revenues are insufficient. As a result, GOBs are less risky for bond holders than are IRBs, carry a lower interest rate and bond financing costs, and are easier to market. (Bond financing costs are typically less than 0.5 percent of total bond issue for GOBs but may be as high as 3 percent for IRBs.) However, because of the full faith and credit pledge, GOBs can typically be used only for projects sponsored by entities having taxation authority. In addition, GOBs do reflect on the debt capacity of the issuer. Consequently, debt capacity ceilings may be reached, precluding subsequent debt issues for financing such projects as hospitals or schools.

System Design

For the purpose of this preliminary feasibility study, the scale and technology for the 300 TPD MCU resource recovery alternative were selected to meet the disposal requirements of Catawba County. However, no attempt was made to optimize a given resource recovery system. Additional analysis must be performed to establish more specifically the scale and configuration of any resource recovery technology to be implemented.

The optimal scale for any given project will depend on the results of the analysis of waste generation, composition, and control (i.e, current waste generation, the supply of processible waste, and the amount of waste available for delivery to a resource recovery project). In addition, the counties need to consider the possible increase in solid waste generation, which depends on population growth in the period 1980-2000. After considering current and projected waste supply, the County will need to decide whether to build: a system that will be too large initially but will accommodate an increasing amount of waste; a system that will too large initially, appropriately sized for the middle of its useful life, and too small in later years; or a system that will be appropriate for the waste supply in its initial years, with some allowance for future expansion as waste generation increases.

Further analysis may be necessary to identify optimal system configuration. For instance, for the MCU systems, fewer but large combustion units may be appropriate.

Legal and Institutional Barriers

There are numerous legal and institutional barriers to the implementation of a resource recovery project, primarily because few projects have been implemented. Instituional and legal barriers include site acquisition problems; traffic impacts on the surrounding neighborhoods and communities; the legality of negotiated procurements, long-term put-or-pay contracts with waste haulers, and take-or-pay contracts with energy users; and the prospect of mandatory participation of private haulers. All of these barriers must be overcome before project implementation.